National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: ATL99FA072	Aircraft Registration Number: N140SW
Occurrence Date: 04/19/1999	Most Critical Injury: Fatal
Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
RYDAL	GA	31171	1246	EDT	

Airport Proximity: Off Airport/Airstrip	Distance From Landing Facility:	Direction From Airport:

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
Beech	T-34A	Airplane

Sightseeing Flight: No Air Medical Transport Flight: No

Narrative

Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:

HISTORY OF FLIGHT

On April 19, 1999, at 1246 eastern daylight time, a Beech T-34A, N140SW, collided with the ground following the in-flight separation of the right wing near Rydal, Georgia. The laser combat simulation flight, "dogfight", was operated by Sky Warriors Aerial Laser Combat under the provisions of Title 14 CFR Part 91 with no flight plan filed. Visual weather conditions prevailed at the time of the accident. The air transport pilot/safety pilot (pilot-in-command) and the pilot/client were fatally injured. The flight departed Fulton County Airport in Atlanta, Georgia, at 1200.

The operator reported that, N140SW and another T-34, N141SW, entered the training area near Rydal to complete the pre-briefed simulation mission as outlined in phase two of the four-phase combat simulation program. Approximately 45 minutes into the mission, both airplanes set up a "beyond visual range engagement". Both airplanes initiated the engagement at a predetermined altitude and direction. After the initial turn toward each other, N140SW started a descending left turn, and an increase roll rate (see attached Operator's Aircraft Accident Report).

The operator reported that the airplane was equipped with an on-board video recorder with three cameras installed to capture the events of the flight. A review of the on-board videotape, the safety pilot provided maneuvering instructions to the client with intercept instructions. Seconds before the accident, as they were in pursuit of the other airplane, the safety pilot of the accident airplane instructed the client to "roll all the way through harder, harder- all the way through. That's it. That's right. Bury your nose, bring it down. That's it, good". The client respond by saying "Okay". As the pursuit continued the safety pilot told the client, "now don't chase him into the ground".

According to the safety pilot of the second T-34, while maneuvering in the left descending turn, the right wing separated from the airplane. The airplane entered a spiral, and impacted the ground on the edge of a nearby tree line, north of a new sub-division.

PERSONNEL INFORMATION

The safety pilot of the accident airplane held an airline transport pilot certificate with single engine land, single engine sea, multi-engine land, and instrument airplane ratings. On November 1998, the safety pilot was issued a first class medical certificate with no limitations. A review the safety pilot's flight experience disclosed that he completed the requirements for the biennial flight review in November 1998; the flight review was taken in a Boeing 767 airplane. The safety pilot had accumulated approximately 15,500 hours of total flight time. The review of the pilot's records showed that he had accumulated a total of 450 hours in the Beech T-34A airplane; within 90 days of the accident, the pilot had flown 20 hours in the Beech T-34A. According to the operator,

National Transportation Safety Board

FACTUAL REPORT
AVIATION

NTSB ID: ATL99FA072

Occurrence Date: 04/19/1999

Occurrence Type: Accident

Narrative (Continued)

the safety pilot had worked for approximately 2 years as a safety pilot for Sky Warriors. The operator also reported that the safety pilot on the accident airplane, as well as all of the safety pilot•s with Sky Warriors are ex-military fighter pilot.

Additional review of the client information disclosed that he was also a certificated pilot. Reportedly, the client was a 25,000-hour retired airline pilot (see attached Supplement "E").

AIRCRAFT INFORMATION

N140SW was owned and operated by Sky Warriors, Inc. Additional information about the airplane is located in the factual report on page 2, under the "Aircraft Information" data field. The T34A/B airplane is a two-place, single-engine, tandem-seat trainer, manufactured by Beech Aircraft Corporation. The airplane was designed to meet the requirements of a primary trainer, and at the same time prepare the student pilot for the transition to heavier, higher-performance aircraft.

The over-all dimensions of the airplane are wingspan 32.8 feet, length 25.9 feet, height at rest 9.6 feet. The normal gross weight of the airplane is 2,950 pounds. The entire T34A and B production was sold to U.S. military customers, or was exported to foreign military customers.

N140SW was also equipped with three video cameras and a VHS video recorder; the accident VHS tape for the accident flight was recovered. Other unspecified mission equipment was also installed on the airplane.

Maintenance records showed that N140SW was routinely inspected under a wing spar X-ray program since 1996; no significant findings were discovered under this inspection program initiated by the operator. According to the operator, records of cumulative "G" loading for each flight were not maintained. The operator also reported that no simulated combat flight ever exceeded the designed "G" loading limits. The design "G" load limits are +6.0 and -3.0.

METEOROLOGICAL INFORMATION

Visual meteorological conditions prevailed at the time of the accident. Additional information about the weather is located on pages 3 and 4, under the section titled "Weather Information."

WRECKAGE AND IMPACT INFORMATION

The main wreckage was located near the intersection of Lauren Lane and Landers Road, near Rydal, Georgia. No evidence of in-flight or postimpact fire was noted. The right wing forward spar had separated at a point just outboard of the forward wing attach fittings. The rear spar had separated in generally two locations. One area involved separation of the upper and lower spar cap assemblies at a point just outboard of the right main landing gear aft trunnion fitting. The other area involved the area of the aft wing attach fittings. The rear spar upper cap assembly separated at a point just outboard of the aft upper wing attach fitting. The aft lower wing attach fitting separated 3.8 inches outboard of the face of the fitting, which is just outboard of the "bathtub" portion of the fitting.

Examination of the accident site disclosed that the main wreckage, with the left wing attached, rested in a 6 foot deep crater adjacent to the tree line. The right wing assembly, minus the inboard over the wing walk surface and the inboard section of the right rear wing spar, was located approximately one mile north of the main wreckage. The remainder of the right wing structure was located 1/4 mile northeast of the wing assembly. Examination of the main wreckage site also disclosed that the tail section of the airframe extended vertically about five feet above ground level. The left wing sustained perpendicular crushing damage along the entire leading edge; the postimpact chord of the left wing was approximately 8 inches long.

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID:	ATL99FA072
Occurrence Date:	04/19/1999
Occurrence Type:	Accident

Narrative (Continued)

Postaccident examinations of the right wing forward and aft spar structures and the left wing forward and aft spar structures were conducted by the National transportation Safety Board (NTSB) Materials Laboratory. The examination revealed that the upper elements of the forward spar assembly from the right wing were separated perpendicular to the length of the wing. This separation occurred 5.8 inches outboard of the wing joint along the upper surface. The lower portions of the forward spar assembly were separated 11.5 inches outboard of the wing joint, at the last rivet hole on the outboard end of the wing fitting tang. The aft spar assembly was separated through the wing fitting area 8.2 inches outboard of the wing joint along the top of the spar assembly and 3.8 inches outboard of the wing joint on the bottom of the assembly.

The aft spar structure was also separated farther outboard on the wing, at the outboard end of the landing trunnion fitting. The fractures in the upper spar structure were matte, textured, and oriented along a shear plane. Examination of the fracture surfaces in the lower spar structure revealed 11 flat, shiny fatigue regions. Use of a scanning electron microscope (SEM) revealed striations, ductile dimples, crack arrest markings, and ratchet marks throughout the fatigue regions. Although the left wing remained attached to the airplane until impact, the fractures in the wing fitting areas of the forward and aft spar assemblies were examined in the laboratory for preexisting cracks similar to that found on the right wing. Visual examination of the fracture surfaces revealed flat striated surfaces. All of the fatigue originated at or near a rivet hole except for the cracking found on the aft strap, which originated in multiple locations along the forward edge. All of the fractures were matte, textured, and oriented along a shear plane.

The aileron remained attached to the right wing, and the control cables for the aileron separated inside the wing. The separated ends exhibited signatures consistent with tension overload. The terminal ends of the cables remained attached to the aileron bell crank. The bell crank sustained impact damage to the up aileron arm, but remained intact and securely attached to the wing. The control rod from the bell crank to the aileron was attached at each end. The flap separated chordwise approximately 12 inches from the outboard end. The outboard end remained attached to the wing. The inboard section of flap sustained impact damage, and remained attached to the inboard section of wing. The flap actuator extension measured 2 1/4 inches, which corresponds to a flap position of 3.75 degrees extended. The fuselage was destroyed and the carry through spar structure also sustained damage. The wing attach fittings were removed from the carry through and sent to the NTSB Materials Laboratory in Washington, DC, for examination.

The front and rear cockpit areas were destroyed during ground impact. Both seats and instrument panels were destroyed. Two G-meters were recovered from the wreckage. One of the G-meters indicated +7.5 and -10.0 Gs. The other G-meter had a single pointer and its position was in the white arc between -5 Gs and +10 Gs. The fuel selector handle had separated from the fuel selector and was free to rotate. The fuel selector valve was not found.

The empennage sustained structural deformation. All the empennage components were complete and intact as an assembly, except the right elevator balance weight that separated during the impact sequence. Elevator control cables were found attached to the intact elevator bell crank. The elevator trim tab actuators were intact, and the tab control chains and cables were continuous into the fuselage. Rudder control cables were found attached to the rudder bell crank, and they were found to be free to operate by pulling on the cables in the fuselage. The rudder trim tab actuator, the tab control chains and cables were continuous into the fuselage.

Supplemental Factual Examination

A survey of spare T-34 forward spar assemblies reportedly found one that contained a joggle in certain members of the lower spar assembly at the approximate location of the right wing separation in the accident airplane. Examination of the accident airplane established the absence of such a joggle in the spar (see attached Supplemental Factual Examination).

National Transportation Safety Board

FACTUAL REPORT
AVIATION

NTSB ID: ATL99FA072

Occurrence Date: 04/19/1999

Occurrence Type: Accident

Narrative (Continued)

MEDICAL AND PATHOLOGICAL INFORMATION

A postmortem examination for the pilot was not performed. The toxicological examinations for the pilot disclosed that 4.1(ug/ml,ug/g) acetaminophen was detected in the blood sample. Unspecified quantities of pseudoephedrine and phenypropanolamine were found in the liver sample.

ADDITIONAL INFORMATION

Wing Spar Examination from N141SW-Damage Discovered May 19, 1996

The forward spar assemblies were reportedly removed from the left and right wings of the aircraft in July 1996, shortly after cracking was discovered in the lower spar structure of the right wing. The spar assemblies were initially examined at the Safety Board's Materials Laboratory and then at the facilities of Raytheon Aircraft Company. The spar assemblies were intact from their inboard end to the cut locations outboard of the wheel well. Visual examination of the left spar assembly revealed no indication of cracking. Visual examination of the right spar assembly revealed a crack in the forward side of the lower center hinge extrusion and a crack in the wing fitting region on the aft J-channel. The center hinge extrusion, outboard of the crack, was displaced. Scanning electron microscopy of the fracture surface revealed numerous linear fatigue origins which spanned the length of the hinge lug radius. Striations were noted both close to and away from the origin; away from the origin, the striations became mixed with bands of ductile dimples. No mechanical damage or deep machining marks were found on the surface of the hinge lug radius where the fatigue originated.

Further examination of the spar assemblies was conducted by Raytheon Aircraft Company using eddy current. No crack indications were found in the left wing forward spar structure. Indications of additional cracking were found in the right wing forward spar structure in the aft J-section, the forward J-section, and the filler strip. Examination of the lower forward hinge angle from the right wing revealed a flat fracture surface with crack arrest markings that originated at the rivet hole on the bottom of the hinge and propagated aft and then up along the hinge angle. Two other cracks were noted in the right wing hinge angle; neither of these cracks was opened for examination. The lower forward hinge angle from the left wing also contained three visible cracks; none of the cracks on the left hinge angle was opened for examination.

Mandatory Service Bulletin 57-3329

Examination of the right wing from N140SW initial separation fractures by NTSB and Raytheon Aircraft Company metallurgists established the presence of fatigue on several of the fracture surfaces. Fatigue cracks have also been found at specific locations in the wing spars of other in-service T-34 airplanes during the process of developing the service bulletin. The YT-34, T-34A, and T-34B airplanes were designed as military trainers. Less than 1,400 were built between 1953 and 1958. At that time, there was no requirement for the establishment of a fatigue life for these three models of military trainer. More important, the accumulated operational service history - the magnitude and number of g-loads - of an individual airplane is unknown. Given the intermingling of spare and salvaged parts installed on airplanes in military service, it is usually impossible to determine accurately the overall history of the airplane. Fatigue cracks at any location in the forward or aft spar will reduce the wing's ability to carry limit load and may result in an in-flight separation of a wing.

The service bulletin provides inspection procedures for the forward (main) and aft (rear) wing spars of airplanes conforming to Type Certificate No. 5A3 to detect fatigue cracks in specified areas only. The specified areas are those where fatigue cracks have been found during investigation of the referenced accident and during preparation of the service bulletin. While inspecting individual airplanes, inspectors are cautioned to carefully examine other accessible areas and structure. During preparation of the service bulletin, corrosion was found on one wing that was

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID:	ATL99FA072
Occurrence Date:	04/19/1999
Occurrence Type:	Accident

Narrative (Continued)

severe enough that the operator elected to replace the wing.

The service bulletin is separated into two parts. Part I provides instructions for the modification and inspection of the forward wing spar structure and aft wing spar structure for fatigue cracks and corrosion at suspected locations. Part II provides a recurring inspection interval at 80-hour intervals.

Videotape Transcription

As previously stated, the airplane was equipped with three video cameras and a video recorder. The videotape from the accident flight was recovered and subsequently transcribed (see attached videotape transcription).

Maneuver

According to Sky Warriors Air Combat Maneuvering Guide, the execution of the accident event incorporates the application of sliceback or pitchback maneuvers. Both maneuvers are set up in the same manner, and uses the horizon and the position of the opponent to determine which maneuver is required. The maneuvering guide has a caution note for each maneuver that states, "When starting a pitchback at high energy levels, an overly aggressive pull could result in an over-G." or "An overly aggressive pull at high energy levels could result in an over-G" (see attached extracts from Sky Warriors Air Combat Maneuvering Guide).

Photogrammetic Evaluation

The photogrammetic evaluation of the video portion of the accident tape determined that there were several factors that prevented the accurate and reliable evaluation. The following factors were considered: 1) The relative high altitude of the airplane at the time of the accident and refraction due to atmospheric effects, 2) The low resolution of the videotape and the ability to select and measure control points on the ground, 3) Recovery of the original wide angle lens for calibration (see attached Photogrammetic evaluation).

The airplane wreckage was released to Mr. Les Cychek , an insurance adjuster with AIG Aviation, Inc. in Atlanta, Georgia.

National Transportation Safety Board

FACTUAL REPORT AVIATION

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Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
		Ft. MSL	0		

Runway Surface Type:

Runway Surface Condition:

Type Instrument Approach:

VFR Approach/Landing:

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
Beech	T-34A	G-130

Airworthiness Certificate(s): Normal

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	2	2950 LBS	1

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Reciprocating	Continental	IO-550	300 HP

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
Annual	02/02/1999	140 Hours	3200 Hours

- Emergency Locator Transmitter (ELT) Information

ELT Installed?	ELT Operated?	ELT Aided in Locating Accident Site?
Yes	No	

Owner/Operator Information

Registered Aircraft Owner	Street Address	City	State	Zip Code
SKY WARRIORS INC.,	3996 AVIATION ST SUITE 1-3	ATLANTA	GA	30336

Operator of Aircraft	Street Address	City	State	Zip Code
Same as Reg'd Aircraft Owner	Same as Reg'd Aircraft Owner			

Operator Does Business As:

Operator Designator Code:

- Type of U.S. Certificate(s) Held: None

Air Carrier Operating Certificate(s):

Operating Certificate:

Operator Certificate:

Regulation Flight Conducted Under: Part 91: General Aviation

Type of Flight Operation Conducted: Other Work Use

National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: ATL99FA072

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First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File	On File	54

Sex: M | Seat Occupied: Rear | Principal Profession: Civilian Pilot | Certificate Number: On File

Certificate(s): Airline Transport

Airplane Rating(s): Multi-engine Land

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): None

Type Rating/Endorsement for Accident/Incident Aircraft? Yes | Current Biennial Flight Review?

Medical Cert.: Class 1 | Medical Cert. Status: Valid Medical--no waivers/lim. | Date of Last Medical Exam: 11/12/1998

- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Mult-Engine	Night	Instrument Actual	Instrument Simulated	Rotorcraft	Glider	Lighter Than Air
Total Time	15500	450	2000	13000						
Pilot In Command(PIC)	14000	425	2000							
Instructor										
Last 90 Days	165	20								
Last 30 Days	65	3								
Last 24 Hours	2									

Seatbelt Used? Yes | Shoulder Harness Used? Yes | Toxicology Performed? Yes | Second Pilot? Yes

Flight Plan/Itinerary

Type of Flight Plan Filed: None

Departure Point	State	Airport Identifier	Departure Time	Time Zone
Same as Accident/Incident Location		FTY	1200	EDT

Destination	State	Airport Identifier
Local Flight		

Type of Clearance: None

Type of Airspace: Class G

Weather Information

Source of Briefing: No record of briefing

Method of Briefing:

National Transportation Safety Board

FACTUAL REPORT AVIATION

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Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
FTY	1153	EDT	841 Ft. MSL	27 NM	185 Deg. Mag.

Sky/Lowest Cloud Condition: Clear 0 Ft. AGL

Condition of Light: Day

Lowest Ceiling: None 0 Ft. AGL

Visibility: 10 SM

Altimeter: 30.00 "Hg

Temperature: 18 °C

Dew Point: 1 °C

Wind Direction: 230

Density Altitude: 1800 Ft.

Wind Speed: 8

Gusts:

Weather Condtions at Accident Site: Visual Conditions

Visibility (RVR): 0 Ft.

Visibility (RVV) 0 SM

Intensity of Precipitation: Unknown

Restrictions to Visibility:

Type of Precipitation: None

Accident Information

Aircraft Damage:

Aircraft Fire:

Aircraft Explosion

Classification:

- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot	1				1
Second Pilot					
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer					
Cabin Attendants					
Other Crew	1				1
Passengers					
- TOTAL ABOARD -	2				2
Other Ground	0	0	0		0
- GRAND TOTAL -	2	0	0		2

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID: ATL99FA072

Occurrence Date: 04/19/1999

Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)

PHILLIP POWELL

Additional Persons Participating in This Accident/Incident Investigation:

BEOTIS WRIGHT
GEORGIA FSDO
COLLEGE PARK, GA